An RNA-based Early Detection Method for Prostate Cancer Using Nanotechnology

Wang, Daisy (School: Boston Latin School)

Prostate cancer is the second leading cause of cancer death among men in the U.S, mainly due to late diagnosis. The current detection method based on blood protein prostate-specific-antigen (PSA) suffers from low specificity, low sensitivity, and poor patient compliance. The goal of this study is to combine nanotechnology and biotechnology to develop a fast, non-invasive, and sensitive method for the early detection of prostate cancer. This project uses a biomarker of prostate cancer antigen (PCA3) RNA for its high specificity, and Surface Enhanced Raman spectroscopy (SERS) is employed for its ultra-sensitive biomolecular detection. Silver nanoparticles were used to enhance the Raman effect, and the mixtures of PCA3 RNA solution and silver nanoparticle were applied onto silicon wafers. The Raman spectrum was obtained with a Horiba Raman spectrometer with a confocal Raman microscope. The SERS method was optimized by exploring different Ag nanoparticle sizes and sample concentrations. The sensitivity for PCA3 was found to be ~0.2 fg/mL, which is about 6 orders of magnitude higher than the current PSA-based method. This developed SERS method is non-invasive, highly specific and sensitive, showing promise for the early detection of prostate cancer.

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